REMARKS

The Office Action of October 3, 2005 has been received and its contents carefully considered.

Revisions to the Application:

The present Amendmetn revises a paragraph on page 11 of the application by deleting a sentence.

The present Amendment also cancels three dependent claims, and revises the independent claims in two primary respects. In the first primary respect, the independent claims have been revised to provide that communication between transmitters and receivers does not require a downlink or a feedback channel. This is supported, for example, by the last sentence in the first paragraph on page 14 of the present application. In the second primary respect, the independent claims have been amended to provide that the receivers know the transmissional patterns (or transmission sequences) sequences of the transmitter modules beforehand (this corresponds to a transmitter-specific function for calculating the next transmitting time). The claim revisions according to this second primary respect are supported (for example) by the sentence at page 11 of the application, lines 30-34, and also by the paragraph bridging pages 17 and 18.

The present Amendment also revises independent claims 1 and 22-24 in order to avoid any confusion about the term "low cross correlation." It means that there is a low probability that the transmitter modules will transmit at the same time (this is the interpretation assumed by the Examiner in the Office Action). Accordingly, the rejection of claims 1 and 22-24 for indefiniteness should be withdrawn. As for claim 20, this one of the dependent claims that has been cancelled.

The Drawings:

The Office Action objects to the drawings on the ground that those which represent prior art should be identified and marked as prior art. This objection is respectfully traversed, since none of the drawings represent prior art. Some of them may superficially appear to look like prior art drawings, but they use different components and algorithms. In detail:

Figure 1 shows the configuration of a playground surrounded by receivers. This may look like a prior art system, but these receivers are not transceivers. There is no feedback from the (receiver) infrastructure to the transmitters.

Figure 2 shows the calculated time of the next transmission burst. Since the origin of the next predicted incoming burst is already known to the system, this is not prior art.

Figure 3 shows a receiving network that is not prior art because of its combination with the receiver matrix.

Figure 4 may look like a prior art system, but it is not prior art with the disclosed transmitters. In reality, however, the non-synchronized clock of the transmitters leads to a continuously changing transmission pattern, which may not be visible on this short time illustration.

Figure 5 shows the arrangement of the receivers, but such a system is not prior art with the receivers as disclosed in the description. This system allows the desired high-speed tracking of more than 100 objects.

Figure 6 shows that there is not any connection between receiver and mobile transmitter, i.e. there is no downlink. This is not prior art.

Figure 7 shows the transmission burst generation circuit. The vco in the drawing is in no way synchronized to a base station or a clock. This means that the data are not changed or influenced after acquisition. This is not prior art.

Figure 8 shows the receiver circuit. It distinguishes over the prior art by using the data input for the calculation of the next predicted arrival time of a specific transmission burst. Additionally, the receiver listens to at least one transmission code which is or can be changed. The sequence of these codes is not fixed and is programmed based on the momentary prediction.

The Rejections on the Prior Art:

The Office Action rejects the independent claims based on U.S. patent 6,204,813 to Wadell et al in view of U.S. patent ,041,046 to Scott et al. These references will hereafter be called simply "Wadell" and "Scott." For the reasons discussed below, it is respectfully submitted that the inventions defined by the current formulation of the independent claims are patentable over these references.

The present application describes a system and method using only object transmitters and infrastructure receivers. To permit this, communication is organized in a new way and the system is controlled without affecting the programmed configuration of the object transmitters, so that the use of a downlink in the operating mode is completely avoided. No downlink is required to link objects and infrastructure time bases and to control the system dynamically. The recognition of each object transmitter time base is done without any remote control from the infrastructure.

Prior to getting started, the components are initialized: the transmitters are programmed (identification code, burst iteration function, modulation type, etc.), and this can be done with a cable or by a very simple radio link (e.g. low bandwidth). The choice of a burst repetition function of each object transmitter can be optimized in order to avoid

superimposing transmitter bursts and also to avoid extended periods that are free of bursts. The configuration (identification code, burst repetition function, modulation type) of each transmitter is also programmed in the infrastructure, so that the infrastructure is able to predict for each transmitter - after receiving a burst - when the next burst is expected.

In contrast to TDMA systems as in Wadell and Scott, where the radio link scheme is periodically the same (a time slot is assigned from a central unit to one distributed object), the pseudo random time division multiplex (PRTDM) according to the invention does not give (or at least does not have to give) any pattern repetition in the radio link (or with a minimal statistical percentage by tracking of a large number of distributed objects). A prior art TDMA system has to be first centrally coordinated, but not the system according to the present application. Applicants' system accepts superimpositions of bursts, because they are randomly distributed (Figure 4). In the case of prior art TDMA systems, however, the superimpositions always meet the same objects.

In acquisition mode, the object transmitters are sending their bursts and the system has to synchronize the time base of the infrastructure with each object time base. This object burst acquisition time is solved in the infrastructure that is now acquiring the signal of each transmitter. For this feature no feedback link is required.

When the infrastructure has found the burst of a particular transmitter, the system is able to track it: the infrastructure can predict when the next burst of a specific transmitter will be received. This can be done with a higher data acquisition rate than in prior art systems, since a downlink is not required for any polling or further communication function.

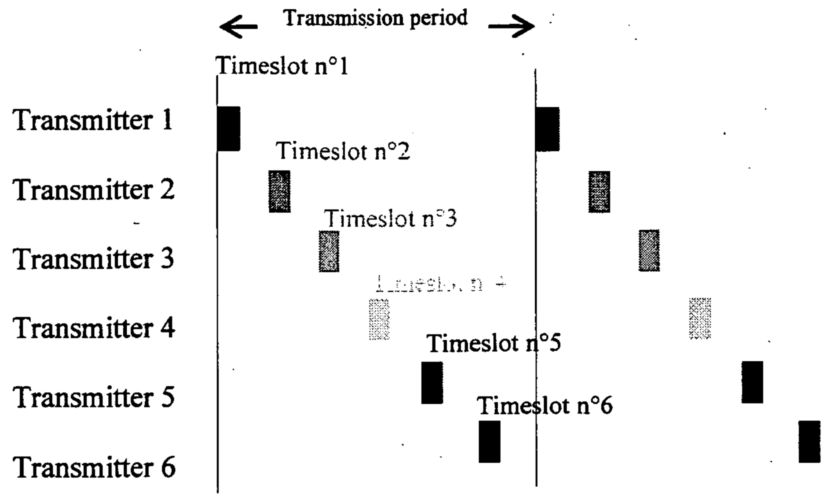
When the infrastructure has "snapped" in the burst pattern of a particular transmitter, it tracks this particular transmitter independently if the other transmitters are already tracked or still being in acquisition.

However, the non-existing downlink is not the only distinction over the prior art. In order to allow a fast and precise position detection even of several objects, the transmission pattern uses a principle of a pseudo-random multiplexing as a mixture of time multiplexing and code multiplexing, i.e. neither a TDMA- nor a CDMA-multiplexing technique is used.

Without a downlink there is no fixed frame, so that the receiving structure has to search for one transmission burst start of each transmitter in the acquisition mode, and the alignment of the bursts of the transmitters in a system is completely random and may change all the time.

There is no time frame and the transmitters are transmitting their transmission bursts as stored in their CPUs. As a consequence, a higher expenditure is necessary at the receiving end as not only the signal has to be processed very fast, but also the receivers have to adjust the next predicted receive time position every time a transmission burst is received in order to take into account the internal clock variations of each transmitter hardware.

Wadell discloses a position detection system using three "tower transmitters" for three dimensional position detection. The reference mentions several known techniques at column 7, lines 9 to 21, but all of them require a specific frame structure for the receiver. The time-of-arrival method used in Wadell requires a sufficiently known starting point. Therefore, this transmission starting point is coordinated by the infrastructure with a downlink. (The passage at column 3, lines 59 to 61 states, "At least three spread spectrum radio transceivers transmit to and receive signals..."; the passage at column 4, lines 29 to 34 refers to instructing "a particular one of the plurality of spread spectrum radio transceivers to transmit a signal that can be processed to determine identity and positional data of the transceivers"). Such a TDMA-method, as described in column 7, lines 22 to 25 and 35 to 37, has the following configuration when (for example) six transmitters are used.



Such a system is centrally coordinated. Each transmitter has a certain predetermined time slot for sending its signal. The time slot number can be fixed or can change from transmission period to transmission period, but in every case the transmission time is predetermined by the infrastructure and an internal time base is continuously synchronized based on the central time base of the infrastructure. Therefore, within a TDMA-system a downlink is all the time necessary.

Scott presents another TDMA-based method comprising a fixed frame structure: No time slot number is fixed for a complete communication and is associated to the mobile user, but the mobile users gets a new time slot number in every frame according to a specific cyclical method. However, the determination of the next time slot number is known to user stations and base station as it was already programmed. When communication is established, a certain pattern is allocated to a specific user. Thus, the user can link into a certain time frame structure and can communicate with the base station according to a time slot number pattern known to both user and base station on beforehand. This helps to reduce transient switching as an error source. But this method is based on a fixed time frame structure that is not used according to the invention , which comprises no such structure.

This means that even in combination, Wadell and Scott do not teach a non synchronized pseudo-random time division multiplexing arrangement wherein a transmission pattern respectively spread sequence known to the transmitters is used to identify the origin of the incoming signals at the receivers without a fixed structure. And this is not only true in respect to a plurality of transmitters, but also in respect of only one transmitter or the reference transmitters.

The technique according to the invention is **not a CDMA-method** as only the known transmission pattern is used to identify the transmitter, i.e. the transmission time code sequence specific to each transmitter, but there is no frame structure as is generally used with CDMA methods.

Generally, CDMA methods are used to transmit higher data rates within a certain frequency band range, which is used by several users. Thus, the same frequency channel is used by several users. The user data are so spread with a code pattern that all overlapping signals can be separated by the receivers because of the different spreading codes. However, the time distance between the transmission start of the spread sequences is the same with all users. In order to guarantee these constant distances, a CDMA system requires all the time a synchronization of the user clock rate with the basis station, i.e. a downlink is necessary.

However, according to Applicants' system, an already-known transmission pattern provides transmitter identification, so that the receiver, when receiving a signal, knows already which signal of which receiver it is receiving, as the code pattern is typical for this specific transmitter. Thus, the transmission patterns can be distinguished and programmed, in order to avoid collisions respectively to minimize signal overlapping. This use of transmitter-specific transmission patterns permits a time independence of the transmission time of all transmitters between each other. Therefore, a transmission pattern can be used as transmitter identification.

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In contrast, Wadell identifies an object identification code after the despreading of the object (the passage at column 7, lines 29-34, states, "The tower transceivers 12 are programmed with a list of object identifications and the corresponding TDMA time slots. The tower transceivers 12 listen to the appropriate time slot for each of the objects and, if an object patch signal is detected, the processor 13 determines the object's identification code...").

Additionally, the code pattern is not transmitter-typical in Wadell, as the following citations show:

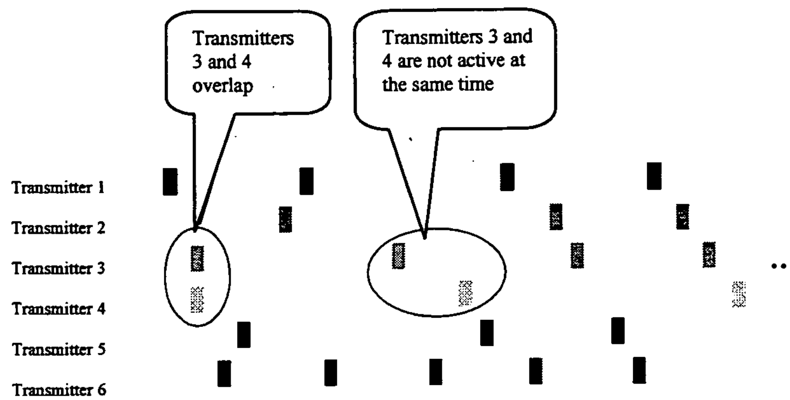
- Column 4, lines 39-41: "The signal processor despreads the signals to determine the identity of the objects...", i.e., the received signal is despreaded first, in order to then decode the identification code and then to learn the origin of the signal.
- There is only an "object patch sequencer" mentioned, however it is not disclosed that it is associated with a specific transceiver.

As a consequence, two signals arriving at the same time with the same spread code can not be distinguished and the information is lost. Therefore, synchronization of the transmitters is essential in Wadell in order to avoid collisions.

Why should Wadell in its CDMA-alternative work this way?

A CDMA method usually works with spread codes that are selected so that they are orthogonal to each other in order to be independent. In dependency of the bit lengths of the bit patterns, the number of orthogonal codes is limited. If more codes are needed as the pure orthogonality allows, the quality of the decoded signals grows worse and especially the receiving time can not be determined unequivocally. Therefore, orthogonal "good" spread codes can be given only in connection with a fixed time frame based on a downlink, if the number of the objects to be tracked is not to be restricted.

However, this is no problem according to Applicants' arrangement as the receiving time can be predicted. The time sequence of the transmission bursts is not predetermined, as the transmitters are not coordinated by a central clock. In operating mode each mobile object starts to transmit its transmission bursts absolutely randomly. This leads to the following transmission picture.



In this example the transmitters emit their bursts with different repeating cycles. Here, a receiver cannot recognize any periodicity with respect to all incoming transmission bursts. Within a time window a completely different number of transmission bursts can be received by the receivers. In the above picture transmitters 3 and 4 are emitting their bursts at the same time ("random superposition"). However, this superposition will usually never repeat.

But at the same time, this does not exclude that a transmitter can send out regular transmission bursts. When the starting point of a sequence is pseudo-random, this means that the sequence will remain pseudo-random thereafter, as there is no synchronization. Even if the transmitters send their bursts in prime number sequences, there is a pseudo random starting point with regular distances thereafter. This represents pseudo-random time division multiplexing using non synchronized pseudo-random patterns, even if there is only one transmitter as the signals of which may collide with the reference transmitters that can also send in the same way or with ambient transmitters.

This explains what is meant by the term "pseudo random time multiplex with non synchronized pseudo random pattern." The transmitters transmit in a time multiplexing, however without any fixed time slots, i.e. without synchronization, according to the restrictive transmission pattern that is only known to the transmitter. This is originally disclosed on page 6 of the present application, last paragraph to page 7, first paragraph. There is no coordination of the time bases of infrastructure and transmitters. In other words, the worlds of the receivers and the transmitters are completely separated from each other.

However, as the available frequency channel is not required for a downlink, the system can be operated with a higher transmission rate than in the prior art. Wadell characterizes a data acquisition rate of 30 Hz as fast (column 12, line 8). At higher data acquisition rates (e.g. in the kilohertz range or even the megahertz range, as disclosed in the present application, for example on page 17, last paragraph), and with a high number of transmitters, Wadell's method can not be used anymore, while a method according to Applicants' arrangement can still be used because of its simplified burst transmissions. Exactly this high velocity of data acquisition allows the use of a system according to the present application on a playground.

System calibration is needed for Applicants' arrangement and has a completely different meaning as compared to TDMA methods. The incoming signals are not coordinated at all according to Applicants' technique. Neither is the transmission start point known, nor does a fixed time frame with corresponding time slots exist. Therefore, the expenditure and quality of the system calibration is important. Such a receiving network has to consider changes in their surrounding during its operation time, as for example the position of the receivers, which are installed on a tower in Wadell and could therefore move in the wind. Thus, the calibration does not only have static, but also complex highly dynamic components.

In Applicants' arrangement, the reference transmitters function like a mobile transmitter, but their positions are exactly known to the system. When a reference transmitter is switched on, it has no link to the infrastructure, i.e. there is no channel between the infrastructure and the reference transmitter. Thus, it transmits exactly like the transmitters in the mobile object, with its bursts being according to its internally generated transmission pattern. This permits continuously calculated correction values in order to calibrate the system to optimize the position detection of the mobile objects.

Conclusion:

The remaining claims depend from the independent claims discussed above and recite additional limitations to further define their inventions, so they are patentable along with their independent claims and need not be further discussed.

For the foregoing reasons, it is respectfully submitted that this application is now in condition for allowance. Reconsideration of the application is therefore respectfully requested.

Respectfully submitted,

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